DOCUMENT RESUME

ED 303 520 TM 012 790

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TITLE The Nature of Field Independence: Percentiles and Factor Structure of the Finding Embedded Figures Test--Research Edition.
PUB DATE 11 Jan 89
NOTE 32p.; Paper presented at the Annual Meeting of the Southwest Educational Research Association (Houston, TX, January 27, 1989).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Cognitive Processes; *College Students; Equated Scores; *Factor Structure; *Field Dependence Independence; Higher Education; Multiple Choice Tests; Personality Measures; *Psychometrics; Test Format; *Test Results; Visual Perception
IDENTIFIERS *Finding Embedded Figures Test Research Edition; Group Embedded Figures Test; *Percentile Ranks

ABSTRACT

This study investigated the nature of field independence by exploring the structure underlying responses to Forms A and B of a multiple-choice measure of field-independence, the Finding Embedded Figures Test (FEFT). Subjects included 302 students (52.7% male) enrolled in mathematics courses at a university in the southern United States. Students completed both forms of the FEFT (each form contained 35 items) or one form of the FEFT and the Group Embedded Figures Test, with different orders of test administration. A total of 225 students completed Form A of the FEFT, 232 students completed Form B of the FEFT, and 155 students completed Forms A and B of the FEFT. Results suggest that the perceptual disembedding manifestations of field independence involve several dimensions, although these dimensions may be subsumed by a common higher-order factor. Results also support the conclusion that the research edition of the FEFT has reasonable psychometric integrity. Eight tables provide percentile equivalent scores, factor structure matrices, and item characteristic maps of the study data; and a 48-item list of references is included. (Author/SLD)

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THE NATURE OF FIELD INDEPENDENCE: PERCENTILES AND FACTOR STRUCTURE OF THE FINDING EMBEDDED FIGURES TEST--RESEARCH EDITION

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Paper presented at the annual meeting of the Southwest Educational Research Association, Houston, TX, January 27, 1989.

TM012790

ABSTRACT

The study investigated the nature of field independence by exploring the structure underlying responses to both forms of a multiple choice measure of field-independence, the Finding Embedded Figures Test. Subjects (n=302) completed both forms of the FEFT or one form of the FEFT and the Group Embedded Figures Test. Results suggests that the perceptual disembedding manifestations of field independence involve several dimensions, though these dimensions may be subsumed by a common higher-order factor.

In the years immediately following World War II, Herman A. Witkin and his colleagues performed a series of historically important studies (e.g., Witkin, 1949) involving stylistic variations in perceptions of visual stimuli. These initial studies investigated variations in ability to perceive the upright in the absence of normally-available orienting stimuli. Witkin, Moore, Goodenough and Cox (1977, pp. 3-4) present photographs of the apparatuses used in these early "rod-and-frame" and "body-adjustment" tests. Heesacker (1981) presents a summary of the early years of this important research, and of the antecedents of the work dating back to the previous century (Jastrow, 1892).

Witkin's early work led to the development of the theory of psychological differentiation and the delineation of a cognitive style that has come to be called field independence/dependence (Goodenough & Witkin, 1977, pp. 2-3). As Witkin (1979, p. 359) explains,

> We designate the tendency to rely on the self as a primary referent in information processing as a field-independent mode of functioning and the tendency to rely on external referents as a field-dependent mode of functioning. These tendencies find widespread expression in an individual's perceptual, intellectual, and social activities.

Persons who tend to operate on the field independence (FI) end of this cognitive style continuum tend to perceive themselves as more segregated from their environments; these persons tend to be more analytical in their abilities and interests.

Persons who tend to operate on the field dependence (FD) end of the continuum, on the other hand, tend to be less able either to distinguish among or to reorganize stimuli. More field dependent persons also tend to be more social in their abilities and interests. Thus, more field-dependent persons have a greater preference to be with people (Bard, 1972; Coates, Lord & Jakobovics, 1975) and may be more popular with their peers (Wong, 1977). Similarly, more field-dependent persons may be more attentive to social cues (Eagle, Goldberger & Breitman, 1969; Fitzgibbons & Goldberger, 1971; Ruble & Nakamura, 1972) and may even prefer to be physically closer to other people (Holley, 1972; Justice, 1969).

Field independence is the most researched of the 19 cognitive styles that have been identified (Goldstein & Blackman, 1978; Messick, 1976). For example, a comprehensive bibliography of studies involving the field-independence construct cites several thousand studies (Cox & Gall, 1981). Various researchers (cf. Donlon, 1977, p. 1; Witkin, Moore, Goodenough & Cox, 1977, p. 1) concur that the construct of field-independence has stimulated great interest.

Two factors primarily account for extraordinary interest in the field-independence construct. First, theorists argue that field independence is value-neutral, and this feature of the construct may appeal to both researchers and practitioners. As Goodenough and Witkin (1977, p. 9) suggest, "The field-dependence-independence dimension is bipolar; that is, it has no clear high or low end. As a consequence the dimension is value-

neutral, in the sense that adaptive qualities are to be found at both poles." The value-neutral nature of the style may help explain why self-esteem is not highly related to field-independence (Hullfish, 1978, p. 835).

A second important factor accounting for interest in the construct is perception that the style is apparently a cognitive manifestation of holistic personality variations. As Witkin, Moore, Goodenough and Cox (1977, p. 15) note,

> Cognitive styles are pervasive dimensions. They cut across the boundaries traditionally--and, we believe, inappropriately--used in compartmentalizing the human psyche and so help restore the psyche to its proper status as a holistic entity.

Similarly, Fry and Charron (1980, p. 530) suggest that

> cognitive style cuts across domains of content, function, process, and value systems, and must therefore be differentiated from cognitive ability that delineates a basic dimension of performance underlying a fairly limited area of content.

The emphasis on a holistic variation in cognitive aspects of personality is in keeping with a recognition that global personality traits, such as neuroticism and dominance, have not tended to explain non-personality variables since global, non-cognitive aspects of personality may be less stable over different situations (Mischel, 1973).

Numerous studies indicate that field-independence has noteworthy associations with myriad outcomes; several reviews of these studies are available elsewhere (cf. Goodenough, 1976;

Goodenough & Witkin, 1977; Melancon & Thompson, 1987; Witkin, Moore, Goodenough & Cox, 1977). However, the general tenor of these diverse findings can be gleaned by considering a few of the many available citations. Field-independence has been found to be related to marital satisfaction (Sabatelli, 1982); to vocational choice (Witkin, Moore, Oltman, Goodenough, Friedman, Owen & Raskin, 1977); to general academic achievement during elementary school years (Wicker, 1980) and in certain cases in older subject groups (Donnarumma, Cox & Beder, 1980); to problem-solving abilities (Ronning, McCurdy & Ballinger, 1984); to concept-learning abilities (Stasz, Shavelson, Cox & Moore, 1976); and to performance in specific subject areas such as art (Copeland, 1983), engineering graphics (Wilson & Davis, 1985), and reading (Pitts & Thompson, 1984; Spiro & Tirre, 1979). Field-independence also affects reaction to different instructional interventions and conditions (cf. Bolocofsky, 1980; Frank & Davis, 1982; Jolly & Strawitz, 1984; Paradise & Block, 1984; Renninger & Snyder, 1983; Saracho, 1980).

Notwithstanding considerable research regarding field independence, the nature of the construct is not entirely clear. Most treatments of field independence are phenomenological rather than explanatory. The primary purpose of the present study was to empirically explore the nature of field independence, in the tradition of "The nature of..." studies conducted by researchers such as Guilford (1967) and Rokeach (1973).

An ancillary purpose of the study was to further explore the psychometric integrity of the Finding Embedded Figures Test

(FEFT) developed by Thompson and Melancon (1987). Melancon and Thompson (1987) present in detail the first phase of development of this multiple-choice measure of perceptual disembedding ability. The measurement quality of the FEFT has been explored using various analytic and design strategies (cf. Melancon & Thompson, 1988, 1989, in press). However, in the present study score percentiles and factor structures for the measure are reported.

The FEFT (Thompson & Melancon, 1987) consists of two forms, both of which contain 35 items in which a subject is required to isolate a target figure within one of five visual stimuli. There are 15 linking or common items employed on both forms A and B of the FEFT.

Method

Subjects

Subjects (n=302) were all the students enrolled in mathematics courses at a university in the southern United States. Slightly more students (52.7%) were male rather than female. The mean age of the students was 19.52 (SD=3.06).

Subjects were randomly assigned in class units to one of four conditions: (a) completion of the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin & Karp, 1971) followed by completion of the Form A FEFT (n=70); (b) completion of the GEFT followed by completion of the Form B FEFT (n=77); (c) Form A FEFT completion followed by Form B (n=76); (d) Form B FEFT completion followed by Form A (n=79). Eta-squared was computed to determine the proportion of variance in FEFT Form A scores associated with

assignment to the three groups ("a", "c" or "d") that received the measure; the calculated value (.032) suggests that the groups did not differ appreciably. The comparable eta-squared statistic (.035) for persons with Form B scores similarly suggests that persons in the groups ("b", "c" or "d") did not differ appreciably.

Results

For the 225 subjects who completed Form A, scores were distributed throughout the range of scores 10 through 35, inclusive; this represents full use of the theoretical range of expected scores on a selection-format test with a theoretical "chance" floor of 7.0 and a ceiling of 35.0. The mean score was 25.18 (*SD*=5.41); thus, scores were distributed near the theoretically ideal mean (21.0) halfway between the test's theoretical floor and the test's ceiling (Thompson & Levitov, 1985). Only three persons scored at the ceiling or perfect score on Form A.

For the 232 subjects who completed FEFT Form B, scores ranged from 8 to 34, inclusive. The mean score was 23.60 (*SD*=5.51), ostensibly suggesting that Form B may be a little harder than Form A. Since some but not all subjects in the two groups were common, the computation of conventional *t*-tests to evaluate these two means would have been difficult. For this reason, and to avoid overinterpretation of statistical significance when samples sizes are reasonably large (Thompson, 1988), the two means were compared by computing standardized effect size estimates analogous to *Z*-scores. These effects are

commonly computed in meta-analytic research. The standardized effect size in this case was relatively small, i.e., 0.289 ((25.18 - 23.60)/5.46).

In any case, an analysis of scores on the 15 common or linking items on the two forms for the 155 subjects who completed both forms suggests that some of the relatively small difference between form means was due to differences in the two samples of subjects who completed the GEFT and only either FEFT Form A or FEFT Form B. For the 155 subjects who completed both FEFT Form A and Form B the mean score on the 15 Form A linking items was 10.75 (*SD*=2.65); the mean score on the same 15 linking items located within Form B and completed by the same 155 subjects was 11.02 (*SD*=2.60). This difference was not statistically significant (*t* = 1.78, *df* = 154, *p* > 0.05), and the standardized effect size estimate was small in magnitude, i.e., 0.103 ((11.02 - 10.75)/2.63).

Table 1 presents FEFT Form A score equivalents for percentiles one through 99. Table 2 presents the corresponding percentiles for FEFT Form A. Table 3 presents total FEFT score equivalents for percentiles one through 99.

INSERT TABLES 1 THROUGH 3 ABOUT HERE.

With respect to factor analysis performed to isolate the structure underlying responses to the 35 Form A FEFT items, the prerotation eigenvalues for the correlation matrix for factors V through X were 1.42, 1.40, 1.27, 1.18, 1.16, and 1.10. The prerotation eigenvalues for the 35 Form B items for factors V through X were 1.45, 1.42, 1.30, 1.28, 1.14, and 1.10,

respectively. The prerotation eigenvalues for the 70 Form A and B items for factors V through X were 2.20, 2.12, 2.03, 2.00, 1.89, and 1.78, respectively. Based on examination of factor interpretability and Cattell's "scree" test, a decision was made to extract seven principal components for solutions for form B data, and for combined forms A and B data. Six principal components were extracted for form A data.

Table 4 presents the factor structure matrix for the 35 Form A FEFT items after rotation to the varimax criterion. Six items had commonality coefficients less than a cutoff of 0.30: item A17 (.15), item A9 (.20), item A6 (.21) (linking item #2), item A5 (.25), item A10 (.26) (linking item #5), and item A14 (.27) (linking item #7).

INSERT TABLE 4 ABOUT HERE.

Table 5 presents the factor structure matrix for the 35 Form B FEFT items after rotation to the varimax criterion. Two items had commonality coefficients less than a cutoff of 0.30: item B16 (.22), and item B27 (.29).

INSERT TABLE 5 ABOUT HERE.

Table 6 presents the factor structure matrix for the 70 Form A and B FEFT items after rotation to the varimax criterion. Nine items had commonality coefficients less than a cutoff of 0.20: item A17 (.12), item A24 (.14) (linking item #14), item A5 (.15), item B23 (.15), item B16 (.16), item B29 (.16) (linking item #14), item B3 (.18), item B13 (.18), and item B21 (.18) (linking item #10).

INSERT TABLE 6 ABOUT HERE.

Discussion

The cognitive style of field independence has attracted serious interest among researchers. As Heesacker (1981, p. 2) notes,

> Since the early 1960s literally hundreds of research papers have looked at various aspects of field dependence. Field dependence is currently one of the most popular research topics in psychology.

The present study was conducted to investigate the nature of field independence using the Finding Embedded Figures Test (FEFT), a measure developed based on studies reported by Melancon and Thompson (1987). The FEFT can be presented in a multiple-choice format that may facilitate administration and scoring in comparison with the use of supply-format tests such as the Group Embedded Figures Test.

The percentiles presented in Tables 1 through 3 suggest that scores on the separate and combined forms of the FEFT are somewhat normally distributed. Coefficients of skewness and kurtosis for form A, form B, and total FEFT scores (respectively, -0.649 and 0.019; -0.324 and -0.283; and -0.496 and -0.246) confirm this impression. As noted within the Results section, scores tended to vary pretty much throughout the full theoretical range for a selection-format administration of the FEFT. These results are one indication that the data provide a viable basis

for exploring the nature of field independence.

In the tradition of Guilford (1967) and of Rokeach (1973), factor analysis can be very useful in exploring "The nature of..." psychological constructs. Thus, the results presented in Tables 4 through 6 may facilitate greater understanding of the nature of field independence. However, the tables do present analyses focusing on relationships among individual item scores, and the items were necessarily scored right-wrong. Such analyses must be interpreted with some caution, since individual items may not be stable in their behavior. Analyses of attitude items are more defensible, because such items are usually not dichotomously scored, and greater score variance on such items tends to yield more reliable item scores and thus more generalizable structures.

Tables 7 and 8 present items sorted across factors, structure coefficients from Tables 4 and 5, and item difficulty (P) and discrimination (r) (i.e., corrected item-to-total score correlation) coefficients. The tables also describe item characteristics. If target shapes were rotated in the stimulus containing the target, the columns headed "Rot" have a one. If target shapes were further filled in by other shapes within the stimulus containing the target, the columns headed "Fill" have a one. Targets deemed fairly simple in their visual complexity are designated with a one in the columns headed "Simp." Targets consisting of readily recognizable geometric shapes (e.g., a circle, a square) are indicated by a one in the columns headed "Geom." Targets that are symmetric in shape are designated with a one in the columns headed "Symm."

INSERT TABLES 7 AND 8 ABOUT HERE.

The two factor structures do not involve exactly the same subjects, i.e., 155 of the 302 subjects were common to both analyses. Furthermore, the two structures involve analyses based on different item sets, i.e., in each analysis only 15 of 35 items were common. Thus, it would not be expected that exactly the same structure would be isolated across solutions.

Nevertheless, some general patterns can be discerned. In the analysis of responses of 225 subjects to the 35 form A items, as Table 7 suggests, factor I apparently involves items in which target shapes were both unrotated and unfilled within the stimulus containing each target. Such items involve the least translation by the subject. Factor II appears to involve items with rotated and unfilled targets. Factor III appears to involve items in which target shapes are uniformly simple in their visual complexity. The remaining factors are not readily interpretable, but were useful in locating the rotated factors in factor space during the rotation process.

As suggested by the results presented in Table 8, the responses of the 232 subjects who completed form B items can partly be grouped according to the size of the target shape being searched for within the five alternative visual stimuli for each item. Factor I involved items of homogeneously small size. Factor II for the form B data primarily involved items for which target shapes were unrotated and unfilled in their presentation within stimuli alternatives. The high structure coefficient for linking item #12 (A21 and B26) on both factor I for form A and factor II

for form B is suggestive that this dimension may be common across solutions. Factor III apears to involve items for which target shapes were both rotated and simple. Factors V appears to involve form B items for which target shapes were visually simple. This form B factor appears to correspond with factor III for the form A data, as suggested partially by the correlation of linking items #4 (A8 and B9) and #5 (A10 and B11) with both factors. Again, the remaining factors are not readily interpretable.

The structure underlying responses of 155 subjects to all 70 items on both forms A and B, presented in Table 5, must be interpreted with great caution, given the larger ratio of items to subjects in this analysis. However, these results can be interpreted in part to determine whether the 15 linking items are associated with common factors in factor space. Three linking items (#5--A10 and B11; #9--A16 and B18; and #14--A24 and B29) are associated with different factors. Since 12 of the 15 linking items were associated with common factors (e.g., linking item #13 (A22 and B28) with Table 6 factor II, linking item #6 (A12 and B14) with factor III), this result is reasonably supportive of a conclusion that the linking items are associated with common factors, as would be anticipated.

The results presented here provide some insight into the nature of perceptual disembedding skills. The results suggest that these skills may be multidimensional, or may involve multiple first-order factors that are subsumed by a general or "g" second-order factor. Thus, the results provide a basis for further inquiry into the perceptual manifestations of a field

independent cognitive style.

The results also provide further support for a conclusion that the research edition of the Finding Embedded Figures Test (FEFT) (Thompson & Melancon, 1987) has reasonable psychometric integrity. It was somewhat surprising that interpretable factors were extracted from dichotomous response data, for reasons noted previously. This favorable result is consonant with previous results (Melancon & Thompson, 1987, 1988, 1989, in press). Thus, further inquiry into the psychometric integrity of the FEFT appears warranted, and is ongoing.

References

Bard, C. (1972). The relation between perceptual style and physical attractiveness. International Journal of Sports Psychology, 3, 107-113.

Bolocofsky, D. N. (1980). Motivational effects of classroom competition as a function of field dependence. Journal of Educational Research, 73, 213-217.

Coates, S., Lord, M., & Jakobovics, E. (1975). Field dependence-independence, social-non-social play and sex differences in preschool children. Perceptual and Motor Skills, 40, 195-202.

Copeland, B. D. (1983). The relationship of cognitive style to academic achievement of university art appreciation students. College Student Journal, 17, 157-162.

Cox, P. W., & Gall, B. E. (1981). Field dependence-independence and psychological differentiation: Bibliography with index supplement No. 5. Princeton, NJ: Educational Testing Service. (ERIC Document Reproduction Service No. ED 214 977)

Donlon, T. F. (1977, May). A practical assessment of field dependence/independence. Paper presented at the annual meeting of the New England Educational Research Association, Manchester-Bedford, NH. (ERIC Document Reproduction Service No. ED 139 827)

Donnarumma, T., Cox, D., & Beder, H. (1980). Success in a high school completion program and its relation to field dependence-independence. Adult Education, 30, 222-232.

Eagle, M., Goldberger, L., & Breitman, M. (1969). Field dependence and memory for social vs neutral and relevant vs irrelevant stimuli. Perceptual and Motor Skills, 29, 903-910.

Fitzgibbons, D. J., & Goldberger, L. (1971). Task and social orientation: A study of field dependence, "arousal," and memory for incidental material. Perceptual and Motor Skills, 32, 167-174.

Frank, B. M., & Davis, J. K. (1982). Effect of field-independence match or mismatch on a communication task. Journal of Educational Psychology, 74, 23-31.

Fry, P. S., & Charron, P. A. (1980). Effects of cognitive style and counselor-client compatibility on client growth. Journal of Counseling Psychology, 27, 529-538.

Goldstein, K. M., & Blackman, S. (1978). Cognitive style. New York: Wiley.

Goodenough, D. R. (1976). The role of individual differences in field dependence as a factor in learning and memory. Psychological Bulletin, 83, 675-694.

Goodenough, D. R., & Witkin, H. A. (1977). Origins of the field-dependent and field-independent cognitive styles (Report No. ETS-RB-77-9). Princeton, NJ: Educational Testing Service. (ERIC Document Reproduction Service No. ED 150 155)

Guilford, J.P. (1967). The nature of human intelligence. New York: McGraw-Hill.

Heesacker, M. (1981, August). A review of the history of field dependence. Paper presented at the annual meeting of the American Psychological Association, Los Angeles. (ERIC Document Reproduction Service No. ED 211 888)

Holley, M. (1972). Field-dependence-independence, sophistication-of-body-concept, and social distance selection (Doctoral

dissertation, New York University). Dissertation Abstracts International, 33, 296B. (University Microfilms No. 72-20,635)

Hullfish, S. (1978). Relationship of role identification, self-esteem, and intelligence to sex differences in field independence. Perceptual and Motor Skills, 47, 835-842.

Jastrow, J. (1892). On the judgment of angles and positions of lines. American Journal of Psychology, 5, 220-223.

Jolly, P. E., & Strawitz, B. M. (1984). Teacher-student cognitive style and achievement in biology. Science Education, 68, 485-490.

Justice, M. T. (1969). Field dependency, intimacy of topic and interperson distance (Doctoral dissertation, University of Florida). Dissertation Abstracts International, 31, 395B-396B. (University Microfilms No. 70-12,243)

Melancon, J. G., & Thompson, B. (1987, November). Measurement characteristics of a test of field-independence: Literature review and development of the Finding Embedded Figures Test. Paper presented at the annual meeting of the Mid-South Educational Research Association, Mobile, AL. (ERIC Document Reproduction Service No. ED 292 823)

Melancon, J. G., & Thompson, B. (1988, November). Latent trait measurement calibrations for the Finding Embedded Figures Test. Paper presented at the annual meeting of the Mid-South Educational Research Association, Louisville, KY.

Melancon, J. G., & Thompson, B. (1989, January). Measurement characteristics of a "no-guessing" administration of the Finding Embedded Figures Test. Paper presented at the annual meeting of the Southwest Educational Research Association,

Houston, TX.

Melancon, J. G., & Thompson, B. (in press). Measurement characteristics of the Finding Embedded Figures Test. Psychology in the Schools.

Messick, S. (1976). Individuality in learning. San Francisco: Jossey-Bass.

Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. Psychological Review, 80, 252-283.

Paradise, L. V., & Block, C. (1984). The relationship of teacher-student cognitive style to academic achievement. Journal of Research and Development in Education, 17, 57-61.

Pitts, M. C., & Thompson, B. (1984). Cognitive styles as mediating variables in inferential comprehension. Reading Research Quarterly, 19, 426-435.

Renninger, K. A., & Snyder, S. S. (1983). Effects of cognitive style on perceived satisfaction and performance among students and teachers. Journal of Educational Psychology, 75, 668-676.

Rokeach, M. (1973). The nature of human values. New York: Free Press.

Ronning, R. R., McCurdy, D., & Ballinger, R. (1984). Individual differences: A third component in problem-solving instruction. Journal of Research in Science Teaching, 21, 71-82.

Ruble, D. N., & Nakamura, C. Y. (1972). Task orientation versus social orientation in young children and their attention to relevant social cues. Child Development, 43, 471-480.

Sabatelli, R. M. (1982, October). Personality and marriage:

Cognitive style and locus of control as mediators of marital complaints. Paper presented at the annual meeting of the National Council on Family Relations, Washington, D.C. (ERIC Document Reproduction Service No. ED 228 570)

Saracho, O. (1980). The relationship between the teachers' cognitive style and their perceptions of their students' academic achievements. Educational Research Quarterly, 5, 40-49.

Spiro, R. J., & Tirre, W. C. (1979). Individual differences in schema utilization during discourse processing. Urbana, IL: Center for the Study of Reading. (ERIC Document Reproduction Service No. ED 166 651)

Stasz, C., Shavelson, R. J., Cox, D. L., & Moore, C. A. (1976). Field independence and the structuring of knowledge in a social studies minicourse. Journal of Educational Psychology, 68, 550-558.

Thompson, B. (1988). A note on statistical significance testing [editorial]. Measurement and Evaluation in Counseling and Development, 20(4), 146-148.

Thompson, B., & Levitov, J. E. (1985). Using microcomputers to score and evaluate test items. Collegiate Microcomputer, 3, 163-168.

Thompson, B., & Melancon, J. (1987). Finding Embedded Figures Test. New Orleans: Psychometrics Group.

Wicker, T. E. (1980, September). The effects of cognitive dissonance or disequilibrium on conservation attainment in field dependent and field independent students. Paper presented at the annual meeting of the American Psychological

Association, Montreal. (ERIC Document Reproduction Services No. ED 195 323)

Wilson, R. C., & Davis, P. D. (1985). The prediction of success in engineering graphics using the Group Embedded Figures Test and the Hidden Figures Test. Journal of Studies in Technical Careers, 7, 65-72.

Witkin, H. A. (1949). The nature and importance of individual differences in perception. Journal of Personality, 18, 145-170.

Witkin, H. A. (1979). Socialization, culture and ecology in the development of group and sex differences in cognitive style. Human Development, 22, 358-372.

Witkin, H. A., Moore, C. A., Goodenough, D. R., & Cox, P. W. (1977). Field-dependent and field-independent cognitive styles and their educational implications. Review of Educational Research, 47, 1-64.

Witkin, H. A., Moore, C. A., Oltman, P. K., Goodenough, D. R., Friedman, F., Owen, D. R., & Raskin, E. (1977). Role of the field-dependent and field-independent cognitive styles in academic evolution: A longitudinal study. Journal of Educational Psychology, 69, 197-211.

Witkin, H.A., Oltman, P.K., Raskin, E., & Karp, S.A. (1971). A manual for the Embedded Figures Tests. Palo Alto, CA: Consulting Psychologists Press.

Wong, K. L. (1977). Psychological differentiation as a determinant of friendship choice (Doctoral dissertation, City University of New York, 1976). Dissertation Abstracts

International, 37, 3639B. (University Microfilms No. 76-30,278)

Table 1
Percentile Equivalent Scores for 35 FEFT Form A Items
(n=225)

PERCENTILE	VALUE	PERCENTILE	VALUE	PERCENTILE	VALUE
1.00	10.260	2.00	12.520	3.00	13.000
4.00	13.000	5.00	13.300	6.00	15.000
7.00	15.820	8.00	16.000	9.00	17.000
10.00	17.000	11.00	18.000	12.00	18.000
13.00	18.380	14.00	19.000	15.00	20.000
16.00	20.000	17.00	21.000	18.00	21.000
19.00	21.000	20.00	21.000	21.00	21.000
22.00	22.000	23.00	22.000	24.00	22.000
25.00	22.000	26.00	22.000	27.00	22.020
28.00	23.000	29.00	23.000	30.00	23.000
31.00	23.000	32.00	23.000	33.00	23.000
34.00	23.840	35.00	24.000	36.00	24.000
37.00	24.000	38.00	24.000	39.00	24.000
40.00	24.000	41.00	24.000	42.00	24.000
43.00	25.000	44.00	25.000	45.00	25.000
46.00	25.000	47.00	25.000	48.00	25.000
49.00	26.000	50.00	26.000	51.00	26.000
52.00	26.000	53.00	26.000	54.00	26.040
55.00	27.000	56.00	27.000	57.00	27.000
58.00	27.000	59.00	27.000	60.00	27.000
61.00	27.000	62.00	27.000	63.00	28.000
64.00	28.000	65.00	28.000	66.00	28.000
67.00	28.000	68.00	28.000	69.00	28.000
70.00	29.000	71.00	29.000	72.00	29.000
73.00	29.000	74.00	29.240	75.00	30.000
76.00	30.000	77.00	30.000	78.00	30.000
79.00	30.000	80.00	30.000	81.00	30.000
82.00	30.000	83.00	30.000	84.00	31.000
85.00	31.000	86.00	31.000	87.00	31.000
88.00	31.000	89.00	31.000	90.00	31.000
91.00	32.000	92.00	32.000	93.00	32.000
94.00	32.000	95.00	32.700	96.00	33.000
97.00	33.000	98.00	34.000	99.00	35.000

Table 2
Percentile Equivalent Scores for 35 FEFT Form B Items
(n=232)

PERCENTILE	VALUE	PERCENTILE	VALUE	PERCENTILE	VALUE
1.00	9.310	2.00	11.620	3.00	12.930
4.00	13.000	5.00	13.000	6.00	14.000
7.00	14.000	8.00	15.000	9.00	15.000
10.00	16.000	11.00	17.000	12.00	17.000
13.00	17.030	14.00	18.000	15.00	18.000
16.00	18.000	17.00	19.000	18.00	19.000
19.00	19.000	20.00	19.000	21.00	19.000
22.00	19.000	23.00	19.000	24.00	19.000
25.00	19.750	26.00	20.000	27.00	20.000
28.00	21.000	29.00	21.000	30.00	21.000
31.00	21.000	32.00	21.000	33.00	21.000
34.00	21.540	35.00	22.000	36.00	22.000
37.00	22.000	38.00	22.780	39.00	23.000
40.00	23.000	41.00	23.000	42.00	23.000
43.00	23.000	44.00	23.000	45.00	23.000
46.00	23.000	47.00	23.000	48.00	23.000
49.00	24.000	50.00	24.000	51.00	24.000
52.00	25.000	53.00	25.000	54.00	25.000
55.00	25.000	56.00	25.000	57.00	25.000
58.00	25.000	59.00	25.000	60.00	25.000
61.00	25.000	62.00	25.000	63.00	25.000
64.00	25.840	65.00	26.000	66.00	26.000
67.00	26.000	68.00	26.000	69.00	27.000
70.00	27.000	71.00	27.000	72.00	27.000
73.00	27.000	74.00	27.000	75.00	27.000
76.00	27.560	77.00	28.000	78.00	28.000
79.00	28.000	80.00	28.000	81.00	29.000
82.00	29.000	83.00	29.000	84.00	29.040
85.00	30.000	86.00	30.000	87.00	30.000
88.00	30.280	89.00	31.000	90.00	31.000
91.00	31.000	92.00	32.000	93.00	32.000
94.00	32.000	95.00	32.450	96.00	33.000
97.00	33.000	98.00	33.000	99.00	33.690

Table 3
Percentile Equivalent Scores for 70 FEFT Form A and B Items
(n=155)

PERCENTILE	VALUE	PERCENTILE	VALUE	PERCENTILE	VALUE
1.00	21.000	2.00	23.240	3.00	25.000
4.00	29.000	5.00	29.000	6.00	29.720
7.00	31.000	8.00	31.000	9.00	32.000
10.00	32.000	11.00	34.000	12.00	34.000
13.00	35.000	14.00	35.840	15.00	37.000
16.00	37.000	17.00	37.520	18.00	39.080
19.00	40.000	20.00	40.000	21.00	40.000
22.00	41.320	23.00	42.000	24.00	43.000
25.00	43.000	26.00	43.000	27.00	43.000
28.00	43.680	29.00	44.000	30.00	44.800
31.00	45.000	32.00	45.000	33.00	45.000
34.00	45.040	35.00	46.000	36.00	46.000
37.00	46.000	38.00	46.000	39.00	46.840
40.00	47.000	41.00	47.000	42.00	47.000
43.00	47.000	44.00	47.640	45.00	48.000
46.00	48.760	47.00	49.000	48.00	49.000
49.00	49.440	50.00	50.000	51.00	50.560
52.00	51.000	53.00	51.000	54.00	51.240
55.00	52.000	56.00	52.000	57.00	52.920
58.00	53.000	59.00	53.000	60.00	53.000
61.00	53.000	62.00	53.000	63.00	53.000
64.00	53.000	65.00	54.000	66.00	54.000
67.00	54.000	68.00	55.000	69.00	55.000
70.00	55.200	71.00	56.000	72.00	56.000
73.00	56.000	74.00	56.000	75.00	57.000
76.00	57.560	77.00	58.000	78.00	58.000
79.00	58.000	80.00	58.000	81.00	58.360
82.00	59.000	83.00	59.000	84.00	59.040
85.00	60.000	86.00	60.160	87.00	61.000
88.00	61.000	89.00	61.840	90.00	62.000
91.00	62.000	92.00	63.000	93.00	63.000
94.00	63.000	95.00	64.000	96.00	64.760
97.00	65.640	98.00	67.000	99.00	69.000

Table 4
Factor Structure Matrix for 35 FEFT Form A Items
(n=225)

Item		Factor I	II	III	IV	V	VI
A34		.69293	.10472	.07614	-.00708	.16580	-.23567
A33		.56212	.06558	.03659	.09495	-.01572	-.00049
A35		.53450	.05609	.04994	-.15011	-.02046	.26229
A21	L12	.53298	.08449	-.11105	.24155	.07641	.17906
A31		.47167	.09234	.19659	.31754	-.07863	-.37481
A28		.37090	.14996	.17980	.01719	.26319	-.18383
A27		-.04530	.61344	.00264	.06626	.17457	-.13982
A18		.34950	.60456	.16724	-.00086	.12376	.02743
A25		.40437	.50985	.00183	.08934	.02565	.06876
A16	L09	-.13676	.49830	-.02296	.47281	-.01768	.03217
A19	L10	.12636	.49485	.27799	-.04782	-.07522	.23342
A23		.12038	.48249	-.09718	.39224	.12744	-.04378
A22	L13	.15202	.38061	-.10150	.21946	-.18734	.18439
A26		.07002	.35661	.32477	.11813	.26054	.26923
A11		.12531	.21651	.52895	.14800	-.19411	-.07257
A8	L04	-.13814	-.07651	.51235	.16898	.21056	.10668
A10	L05	.05158	.01390	.47476	.02162	.15819	.06575
A5		.12193	-.08548	.47447	.03225	.00114	.04181
A9		.01321	.12449	.38868	-.01868	-.14758	.12795
A1		-.15609	-.01423	.37885	.36515	-.00049	.33637
A3	L01	.29618	.28030	.31327	.02160	.07850	-.17769
A32		.46588	-.07579	-.13530	.55826	.00039	-.11588
A4		.24642	.01912	.03122	.51718	.09370	.19421
A12	L06	-.07857	.12257	.41688	.47587	-.12358	.03371
A13		.09362	.00466	.37193	.43835	.19357	-.13894
A29	L15	.05298	.13556	.16808	.39295	.30249	.15013
A17		.06216	.09710	.05481	.34669	.09869	.04454
A6	L02	-.12194	.15552	.20318	.31724	.16269	-.08591
A24	L14	.10718	.22140	-.12614	.08726	.57195	.03259
A7	L03	-.01709	-.13096	.23179	.20489	.53149	.00511
A14	L07	.12860	-.01361	-.14399	.06603	.47903	.05648
A2		-.08876	.21603	.35313	-.04357	.43652	.16354
A20	L11	.02477	.32572	.28031	.15321	.38622	-.25041
A30		.07056	-.06013	.11088	.03952	.11766	.70495
A15	L08	-.07638	.19009	.20350	.14793	.00572	.52345

Table 5
Factor Structure Matrix for 35 FEFT Form B Items
(n=232)

Item		Factor I	II	III	IV	V	VI	VII
B24		.58272	.03376	.11695	.20291	-.09202	.08317	.03778
B7		.54585	.09369	.18418	-.05972	.00459	.14432	.22447
B8		.53791	.16394	.06839	-.07149	.20787	-.16579	-.13068
B12		.50502	-.17314	-.07068	.04173	.08564	.28078	.16168
B25		.48295	.34471	.25322	.19142	-.15654	.15754	.00356
B27		.43763	.24741	-.06368	.05372	-.03435	-.15502	.05426
B20		.37985	.13821	.22458	.28286	.06820	.12810	-.10174
B28	L13	.20324	.57304	.00955	-.08657	.20699	-.22484	.14295
B26	L12	.01993	.57087	.43697	-.02273	.12657	-.13228	.11629
B34		.07380	.56864	-.23792	.19379	-.17531	.06387	.20482
B35		.04152	.53183	-.00015	.03463	.01990	.22566	-.03577
B31		.14303	.49905	.10540	.14966	.07239	.10071	-.14757
B16		.22866	.31924	.10591	.14634	-.14316	.10779	-.03222
B1	L01	.13261	.06127	.57488	.23119	-.02328	-.19281	-.12297
B15	L07	.04151	-.02464	.55347	-.09504	-.11852	.15545	-.07532
B5	L02	-.01846	-.06779	.55293	.18613	.14097	.16889	.12572
B18	L09	.13226	.13023	.44421	.14156	.22206	-.04020	.16536
B22	L11	.21389	.27865	.39136	.04884	.17650	.24115	.02121
B10		.06069	.13944	.31986	.57790	.02647	.06061	.09577
B21	L10	-.02714	.20384	-.21339	.56646	.16148	-.07669	-.05094
B17	L08	.11650	-.08495	.16762	.51392	-.05628	.19703	.05524
B14	L06	.03366	.04394	.06772	.48635	.46656	.08197	-.03808
B33		.13222	.20545	.06623	.44862	.09149	.05150	.34403
B4		-.07712	-.04944	.02169	-.01374	.61952	.10517	-.00169
B2		-.03087	.07489	.03156	.07765	.55595	-.01258	.16677
B9	L04	.18951	-.06034	.07236	.20567	.47812	.08977	-.24811
B11	L05	.26306	.21238	.10407	-.09617	.37656	.24797	.09255
B13		.07797	.05890	.05896	.00559	.12743	.61411	.01407
B3		.14281	.04423	.05412	.17782	.11086	.58552	.03267
B32	L15	-.09082	.34099	.17643	.14540	-.03813	.42882	.23669
B6	L03	.06547	.12588	.05292	.18337	-.02711	.21290	.52025
B29	L14	.29230	.25886	.06228	.05313	.13245	.12964	-.49668
B30		.34540	.12663	-.07848	-.05338	.14408	.12504	.46120
B23		.19228	-.17432	.11746	.21801	.16152	-.31235	.44303
B19		.20891	.10562	.31449	-.18841	.14561	.09726	.35015

Table 6
Factor Structure Matrix for 70 FEFT Form A and B Items
(n=155)

Item		Factor I	II	III	IV	V	VI	VII
A34		.63922	.08522	-.12601	-.16138	.17814	.15306	-.13162
B24		.57920	.08402	.06889	.08250	-.06572	.09785	.08784
A31		.57746	.06679	.17571	-.06899	.14415	.14715	-.03226
B27		.55045	-.18944	.15889	-.06099	-.05919	-.02907	.05947
A28		.50173	.20275	.10181	-.00081	.10758	.05252	.10605
B8		.48871	.11714	.07329	.08326	.00293	-.10458	.23769
B25		.40881	.19911	.26338	.40192	-.09923	.23877	-.12388
B7		.39447	.31418	.09255	.17091	.10476	.12256	.11568
B12		.38237	.01470	.03686	.23821	.16303	-.05930	.23887
A32		.37486	.31016	-.00945	.12362	-.07938	.09308	-.00357
B35		.35055	.19101	.06666	.11730	.15101	.01874	-.30437
B29	L14	.34072	.10104	.15037	.08983	-.06897	.02214	.04995
A35		.33523	.13362	-.31478	.04496	.04140	.08416	-.11121
B31		.32258	.10151	.19075	.23547	.04774	-.05053	-.23469
B16		.28194	.06451	.17706	.19150	.06897	.05483	.07227
B28	L13	.14198	.63075	.01551	.06776	.10587	-.12841	.02414
A22	L13	-.03897	.56120	-.00664	-.00371	.03896	-.06411	-.01188
B20		.21996	.55751	.20344	.02942	-.12918	-.03585	.11063
A16	L09	-.01337	.46418	.42836	.12653	.11603	.01551	.10901
B26	L12	.11176	.46297	.01621	.13869	.07165	.39720	-.06491
A19	L10	.00265	.45040	.03619	-.01821	.41867	.04526	.14791
A23		.02890	.44525	.32832	.06009	.08812	.06730	-.01484
A21	L12	.31904	.42310	.00131	.06590	-.06075	.17124	-.13714
A25		.17124	.38458	-.07754	.06664	.34463	.21613	-.07200
A4		.17837	.35696	.14907	.20072	-.03726	.21587	.16290
A5		.12160	.25107	-.04291	.14314	-.02025	-.00641	.22617
B21	L10	.12665	.23526	.17171	.03818	.01476	-.17915	.20819
B14	L06	.14240	.03943	.63053	-.01149	.11673	-.03366	.16217
B10		.21874	.21075	.56584	.14323	.04893	.15527	-.05989
A12	L06	.08057	.06457	.51640	.06798	.21185	.03330	.16760
B18	L09	.11761	.21451	.40633	.04986	.04786	.22549	-.05208
A20	L11	.21451	.08071	.37344	.23685	.25175	.34102	.09601
A11		.30781	.00142	.36033	.06369	.22739	-.00872	.17432
B22	L11	.20646	.26451	.35336	.30119	-.02784	.08918	-.02591
A13		.32665	.02251	.33438	.30303	.06665	-.00155	.16009
B33		.25662	.01038	.28137	.21804	.18060	.01592	.12972
A17		.12216	.04545	.23956	.16728	.00339	.00351	.12314
A29	L15	.05512	.00821	.34792	.65547	.03471	.22584	-.09006
B32	L15	.08335	-.06248	.27336	.64525	.17148	.11007	-.29168
B6	L03	-.07039	.11112	-.02584	.61169	.24566	.02314	.14794
A7	L03	.02860	-.04085	-.13505	.59986	.09167	.06877	.23035
A15	L08	-.01719	.19159	.11042	.37794	-.13063	.11719	.29040
B17	L08	.09600	.24995	.22997	.35809	-.23045	.06660	.07759
B30		.16031	.09963	.08538	.34527	.25005	-.10206	.09160
A30		-.14330	.19406	-.20868	.32062	.05036	.23950	.14151
A24	L14	.20155	.16427	-.00093	.27263	-.03335	.00672	-.01150

B3		.08537	.21060	.13053	.24649	.20632	-.00880	.06410
A9		-.05366	-.08238	.13206	.13528	.51039	-.02956	.01292
A27		-.15488	.11088	.23079	-.05332	.49624	.05283	-.05025
B11	L05	.25688	.04530	-.13178	.13402	.48182	.12814	.18366
A26		.10214	.11504	.02044	.34625	.41963	.09154	.19532
B2		-.02905	.01116	.31079	.02050	.40565	-.05505	.12993
B19		.16741	.36952	.03154	.03606	.39768	.14461	-.14040
B4		.03103	-.04388	.29274	.02297	.34196	-.11470	-.01974
B13		.09949	-.04154	.08737	.26539	.27188	-.10573	-.02226
B15	L07	.12406	-.04034	.00978	.12213	-.09715	.72007	-.06530
A14	L07	.17045	-.12178	-.14584	.15853	-.01797	.59988	.01148
A6	L02	-.08162	.00492	.29557	.03757	.03361	.48120	.34450
B5	L02	-.09531	.07799	.36562	.14583	.12675	.45725	.15971
B1	L01	.17815	.29995	.21465	-.11299	-.01243	.42863	.12443
A18		.19636	.36410	.24966	-.00300	.32321	.39583	-.16219
A3	L01	.20485	.14581	.09363	-.14835	.27993	.34573	.10056
A8	L04	.13023	-.04590	.10717	.20575	.09267	.03591	.61489
B9	L04	.14958	-.01887	.24801	.02866	.02631	.00484	.56510
A1		-.11590	.15933	.15738	.19734	.05665	.04239	.40834
A10	L05	.19056	.16251	-.14090	.10649	.28897	.08375	.40433
A2		.16929	.05552	.03169	.13137	.31958	.13965	.38650
A33		.34146	.10444	-.03515	.10000	.16873	.14061	-.34877
B23		.05168	.02272	.20451	-.05633	.04900	.03218	.30829
B34		.22700	.07175	.12809	.21936	-.02853	-.25783	-.28503

Table 7
Item Characteristic Map for Form A
(n=225)

Item		Rot	Fill	Simp	Geom	Symm	%	Factor	Rank	P	r	Struc. Coef.
34							10	I	1	.84	.43	.69
33							10	I	2	.73	.29	.56
35				1	1	1	10	I	3	.86	.22	.53
21	L12			1			5	I	4	.86	.29	.53
31							5	I	5	.77	.39	.47
28		1					5	I	6	.76	.25	.37
27		1					10	II	1	.86	.29	.61
18		1		1			5	II	2	.88	.42	.60
25		1			1		5	II	3	.80	.33	.51
16	L09	1		1			10	II	4	.80	.33	.50
19	L10	1		1			10	II	5	.84	.34	.49
23		1					5	II	6	.87	.33	.48
22	L13						5	II	7	.93	.20	.38
26				1	1	1	5	II	8	.66	.32	.36
11		1		1	1		20	III	1	.72	.27	.53
8	L04			1	1	1	5	III	2	.76	.23	.51
10	L05	1		1			10	III	3	.65	.20	.47
5		1		1			10	III	4	.43	.16	.47
9			1	1			10	III	5	.37	.17	.39
1			1	1	1	1	5	III	6	.65	.32	.38
3	L01	1	1	1			10	III	7	.91	.30	.31
32		1					10	IV	1	.79	.36	.56
4		1	1				10	IV	2	.77	.29	.52
12	L06		1	1	1	1	10	IV	3	.68	.29	.48
13		1		1	1	1	10	IV	4	.67	.27	.44
29	L15			1		1	5	IV	5	.76	.31	.39
17		1		1			10	IV	6	.66	.15	.35
6	L02	1		1		1	25	IV	7	.75	.22	.32
24	L14						5	V	1	.74	.25	.57
7	L03	1		1			10	V	2	.39	.21	.53
14	L07	1		1	1	1	10	V	3	.81	.18	.48
2			1	1	1		10	V	4	.69	.26	.44
20	L11	1		1			5	V	5	.64	.28	.39
30		1		1	1	1	5	VI	1	.50	.30	.70
15	L08		1	1			25	VI	2	.38	.25	.52
Mean		.57	.20	.68	.31	.28	9.14					

Table 8
Item Characteristic Map for Form B
(n=232)

Item		Rot	Fill	Simp	Geom	Symm	%	Factor	Rank	P	r	Struc. Coef.
24		1					5	I	1	.56	.26	.58
7							5	I	2	.51	.28	.54
8		1					5	I	3	.68	.23	.54
12				1			5	I	4	.69	.23	.50
25		1					5	I	5	.66	.43	.48
27				1	1	1	5	I	6	.87	.17	.44
20		1					5	I	7	.76	.33	.38
28	L13						5	II	1	.86	.33	.57
26	L12			1			5	II	2	.83	.37	.57
34							15	II	3	.91	.25	.57
35							5	II	4	.60	.23	.53
31		1					10	II	5	.80	.26	.50
16			1				10	II	6	.63	.19	.32
1	L01	1	1	1			10	III	1	.91	.28	.57
15	L07	1		1	1	1	10	III	2	.85	.19	.55
5	L02	1		1		1	25	III	3	.76	.27	.55
18	L09	1		1			10	III	4	.85	.28	.44
22	L11	1		1			5	III	5	.72	.31	.39
10							5	IV	1	.60	.35	.58
21	L10	1		1			10	IV	2	.88	.18	.57
17	L08		1	1			25	IV	3	.37	.20	.51
14	L06		1	1	1	1	10	IV	4	.66	.28	.49
33		1			1		25	IV	5	.70	.30	.45
4			1	1	1	1	5	V	1	.60	.17	.62
2		1		1	1	1	5	V	2	.37	.19	.56
9	L04			1	1	1	5	V	3	.81	.25	.48
11	L05	1		1			10	V	4	.66	.24	.38
13		1		1			5	VI	1	.28	.21	.61
3		1					5	VI	2	.20	.24	.58
32	L15			1		1	5	VI	3	.73	.30	.43
6	L03	1		1			10	VII	1	.36	.19	.52
29	L14						5	VII	2	.75	.26	-.50
30				1			5	VII	3	.52	.21	.46
23		1	1	1	1	1	10	VII	4	.69	.18	.44
19			1	1			20	VII	5	.95	.20	.35
Mean		.51	.20	.60	.22	.25	8.85					